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Investigation of echogenic surface enhancements for improved needle visualization in ultrasonography: A PRISMA systematic review.

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Abstract: *Background:* Visualization of standard needles at steep angles in clinical Ultrasound (US) images is a problematic and important concern. This systematic review evaluates published studies that investigate echogenic needles and how surface enhancements can improve needle visualization. *Method:* A systematic search was performed in five databases: Cochrane Library, Embase (through Ovid), MEDLINE (through PubMed), Scopus, and Web of Science from inception to April 12th, 2017. Each search was based on the search terms: ultrasound, needle, visualization, and comparison, with related synonyms and spelling matters. *Results:* 29 studies were identified and included in the qualitative synthesis. *Conclusion:* Overall, studies agree, that echogenic surface enhancements improve needle visualization in US images at steep angles regardless of target, applied US device and probe, operators, assessors, and methods of assessment.

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